Leo Wickström

Modern Press Felts

During the last few years there has been a development towards an increased use of needled wet felts to the sacrifice of woven felts. Figure 1 shows that 80% of Nordiskafilt's deliveries of wet felts in 1964 were woven and only 20% needled. The needled types then increased rapidly, totalling 82% in 1971. This trend is still going on. The diagram also shows that Nordiskafilt started to deliver all-synthetic needled wet felts in 1968 and that this group then rapidly increased so that it now accounts for more than half of all needled types.

One of the reasons for this development is that the needling technique makes it possible to utilize higher synthetic fibre contents. For known reasons, woven felts have to be fulled in order to receive a smooth felt surface. This is impossible with the synthetic fibres.

We can distinguish between three groups of needled wet felts which in principle have different structures. Felts from these different groups perform in different ways in the press section, depending on different compressibility. The groups and their characteristics are as follows : (Figure 2)

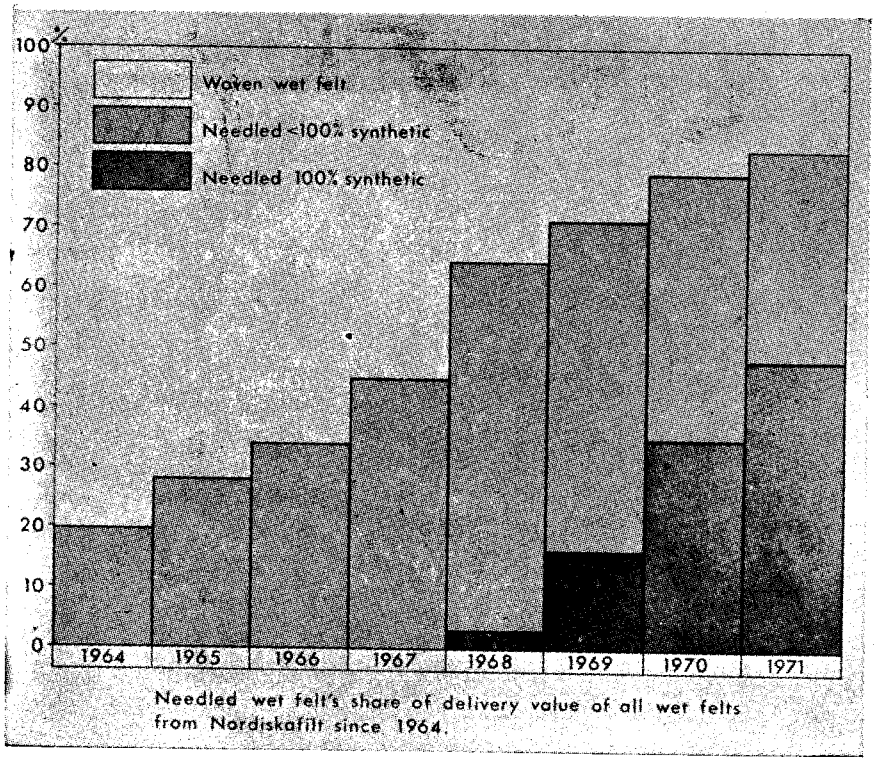

Fig. 1

A Wet felts with a baseweave :
(batt–on–base)
With a medium compressibility

B Wet felts without a baseweave :
(non–woven)
With the highest compressibility.
They can be dried
by pressing.

C Combination felts :
(batt–on–mesh)
With a small or no compressibility.
They cannot be dried
by pressing.

Fig. 2

The following table shows different types of wet felts. Here the needled felts are grouped according to the characteristics just mentioned. The table also gives the Nordiskafilt trade names of the different styles (Figure 3).

I Woven wet felts	
II Needled wet felts	
A Felts with a baseweave of spun yarns	
1) Conventional baseweave	DURATEX
2) Fillingless baseweave	DURATEX SPECIAL
3) Monofilament-stabilized fillingless	PERMATEX
B Felts without a baseweave (non-woven)	NOVOTEX
C Combination felts (batt-on-mesh)	COMBITEX

Fig. 3

Leo Wickström, Nordiskafilt, Hälmstad, Sweden

Duratex

The conventional, needled wet felt is manufactured by needling one or serveral web batts into a baseweave that corresponds to a common woven wet felt, i. e. the base is manufactured from soft, spun yarns from relatively short fibres.

Figure 4 shows a DURATEX, which is our name for a conventional, needled wet felt. This can be all-synthetic or it can also contain wool.

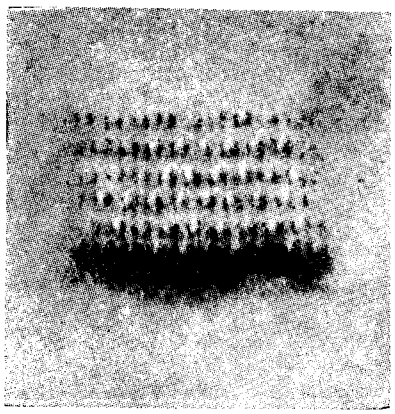

Fig. 4

The web has been taken away from the centre portion of this picture so that the baseweave structure can be seen as a system of intermesh yarns.

Figure 5 shows two baseweaves. The finer one is, of course, used for finer papers; the coarser one is an example of a type used for liner, fluting and other coarser paper grades. Still coarser baseweaves are used in nedled felts for pulp drying machines. Different baseweaves, different batt types and material, and different wool content are some variables when making felts for different purposes. But there are more variables such as type of needle, needling technique and chemical treatment.

In this connection, I shall give an example to show the rapid development of needled wet felts. A couple of years ago, woven wet felts lasted only approximately one week as pick-up felts on high-speed newsprint machines. Low synthetic needled felts then lasted 2–4 weeks. However, with all-synthetic DURATEX felts, running times of three months were achieved. The record is 3 months and 20 days with a 9 15-m-wide pick-up felt on a newsprint machine running with a calculated average speed of 732 m/min. during the life of this felt.

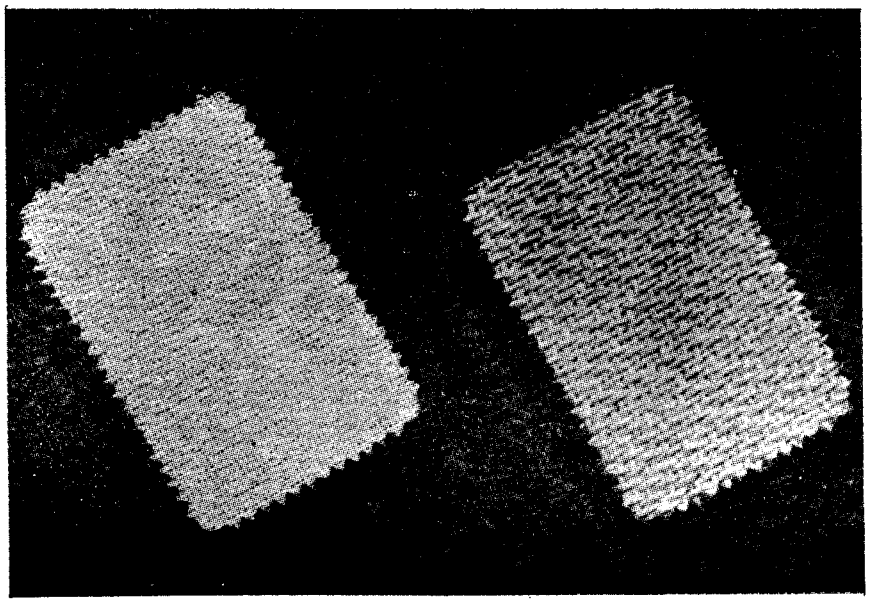

Fig. 5

Regarding conventional. needled wet felts, it can generally be said that a higher synthetic fibre content also means a stronger felt. Running time will therefore be so long that the felt may get dirty before it is worn out. This is often the case if the felt cannot be washed or conditioned properly. High-pressure showers and full-width suction box equipment are therefore standard. With an all-synthetic wet felt, washing with, for example, a 5% solution of caustic soda is also very useful.

Fillingless wet felt-DURATEX SPECIAL

Laboratory investigations have shown that particles of impurities fasten mainly in the baseweave. Thus one investigation showed that of all the impurities in a used conventional, needled wet felt, 72% had fastened in the crosswise yarns of the baseweave, 22% were in the lengthwise threads of the baseweave, and the remaining 6% were in the batt. These figures are surprising, but it should be remembered that the batt was kept clean by good felt cleaning equipment.

These facts indicate that an open base is desirable. One way to get an open baseweave is to leave out the crosswise yarns from the

baseweave, especially as just these seem to gather impurities. Such felts are also made, and they are known as "Fillingless felts". Nordiskafilt's trade-name is DURATEX SPECIAL.

Figure 6 shows such a felt. The baseweave structure can be seen in the centre where the batt is taken away. In the picture we can see thinly woven, lightly twisted fine yarns in the crosswise direction. These are only used to simplify the manufacturing process and will later on partly be disintegrated during the needling process.

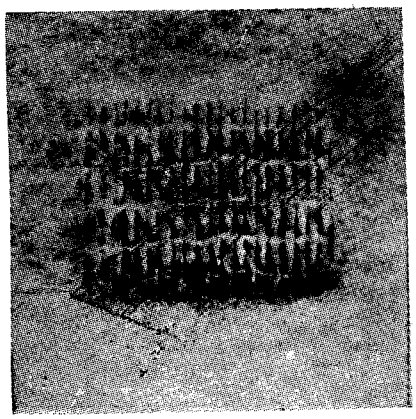

Fig. 6

Of course, felts without crosswise yarns in the baseweave do have a somewhat reduced width stability. This can be compensated for to some extent by using a higher synthetic content in the felt. We therefore manufacture this type of felt all-synthetic or with not more than a 50% wool content. Because of the lower width stability, we have recommended this type for narrower and slower machines, in the first place for fine paper machines and for board machines.

The fillingless felts are extremely open and they are not clogging so easily as the conventional, needled type. Another advantage is that the baseweave has no cross-over points, which means less marking risk and more even pressure distribution in the press nip and therefore better drainage of the paper sheet. Of course, DURATEX SPECIAL also can mark the sheet if the lengthwise yarns are too coarse or if the batt layer is too thin.

The fillingless felt has been well received wherever introduced. Many manufacturers are working on getting it more stable for the larger and high-speed machines. We at Nordiskafilt have solved this problem by a special weave-design that has changed felt structure and characteristics to the extent that we can talk about an entirely new type of felt.

PERMATEX - Monofilament-stabilized fillingless felt

During the manufacturing process of a needled felt, there is a certain width contraction because of the lengthwise yarns of the baseweave packing together. A conventional, needled felt contracts by approximately 30%, while the figure is about 50% for a fillingless felt. It is a definite advantage if this contraction or shrinkage can be kept to a minimum, since it will then be easier to control weight variation of the finished felt.

Our invention is to incorporate fine, stiff monofilament fillings in the felts. Thus we can almost entirely eliminate shrinkage during the manufacturing process. Width stability is also maintained when the felt is later on running in the paper machine.

Figure 7 shows such a stabilized-fillingless felt that we call PERMATEX. The crosswise monofilaments

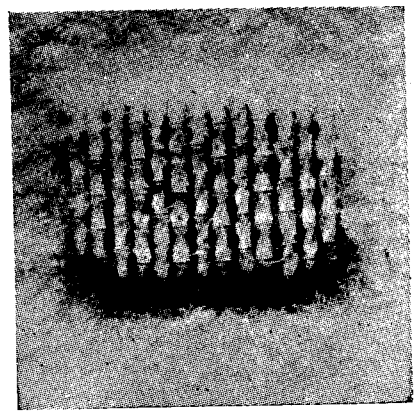

Fig. 7

are clearly visible in the picture. I should mention that this construction is a unique product that Nordiskafilt already is granted a patent for in Sweden and Canada, while patents are pending for other countries. PERMATEX is extremely open because the monofilaments are keeping the distance between the lengthwise threads constant. The baseweave is very thin and light, which gives the felt an even structure. Width stability is excellent because of the crosswise monofilaments. Figure 8 shows a cut-away through the felt. The monofilament ends are clearly visible as small, dark points. The name PERMATEX also emphasizes that the felt has a high and permanent permeability. An ordinary felt is very often plugged because the baseweave is too dense and collects or filters a lot of dirt particles. If the baseweave is too dense,

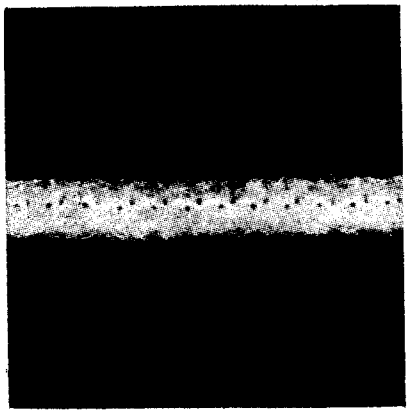

Fig 8

this can be compensated by utilizing a coarser web. However, it is then possible that too large a rewetting will occur to the paper in the outgoing nip. Because the baseweave of PERMATEX is so open and cannot be packed, we can use a much finer web, and the risk of plugging will then be relatively small. This is a very important question, especially concerning felts for later presses, where rewetting has greater significance.

PERMATEX has been rapidly accepted in the paper industry. It was introduced in 1969, when we delivered 90 of them. Already the following year, 1970, the figure was 8-fold or, to be exact, 736.

With regard to running time, one example should indicate the possibilities in that respect. A 7.2-m-wide PERMATEX, 1180 g/sqm, was operating on the 2nd suction press of a machine for white liner board for 203 days. It was removed in fairly good condition because of a press roll change.

The baseweave can also be spliced in order to make long making felts for cylinder machines. Such felts ought to be very open and resistant against stretching. The nonmarking structure of PERMATEX is also of advantage for finer boards.

NOVOTEX-the baseless felt or nonwoven

As previously mentioned, it is mainly the baseweave of a needled felt that collects the fibre particles and other impurities. The more open the baseweave, the better the felt stays open. If we eliminate the baseweave altogether, the openness should be the best possible, provided that the batt can be needled as open as for conventional types of needled felts.

Different manufacturers have for some time been occupied with the construction of baseless felts (nonwoven). The first types were, however, held together with latex, and permeability and dimensional stability were not quite satisfactory. We at Nordiskafilt have developed our own method and designed our own machinery for the manufacture of this type of felt. At the moment we are limited to maximum felt sizes of 35×5 metres.

We call our baseles felt NOVOTEX. It is manufactured entirely from all-synthetic fibres in order to give sufficient strength. Figure 9 shows a cut-away, of this type. Figure 10 shows the same cut-away, but in a greater magnification.

The non-woven felt is considered to come closest to the ideal press felts as defined by Wahlstrom in his pressing theory :"The felt for optimal performance shall give :

1) a perfectly even pressure distribution

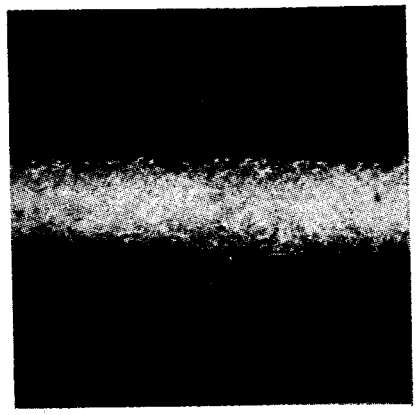

Fig. 9

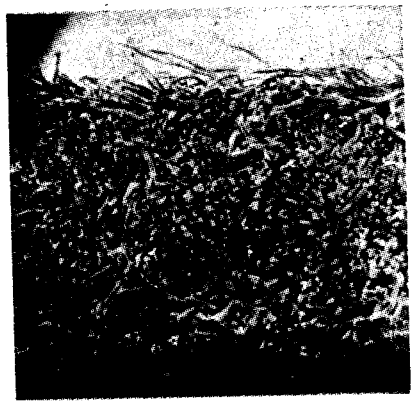

Fig. 10

2) lowest possible flow resistance in the nip
3) least possible rewetting in the outgoing part of the nip".

Because of the lack of a baseweave, the non-woven felt is extremely free from marking, has a high compressibility, and the tendency to clog is relatively small.

A high compressibility of a press felt means that it will run very dry through the nip. There are thus less demands for good dewatering outside the press, e. g. with a suction box or a squeeze press. A soft, compressible felt has a dampening effect on press vibrations. Such a felt also better

resists paper lumps passing the press. Paper lumps are more easily fed through the press with soft felts, and this means less risk for wad burning.

The paper-technical advantages of NOVOTEX, and on which positions it preferably should be used, are obvious, The advantages have already been partly emphasized, but I shall sum them up here :

1) Felt marking is reduced to a minimum.
2) It is possible to achieve a higher dry content for finer paper, where we are dependent on the best possible pressure distribution
3) The felt is easy to dewater and keep clean, as there is no base-weave to prevent the flow or to accelerate plugging.
4) The felt runs relatively dry in the press, which means that rewetting can be reduced, especially if the felt is manufactured with fine surface fibres.

The non-woven felt NOVOTEX is therefore mainly suitable for :

1) Presses where we want to avoid felt marking in the paper sheet, e. g. writing, printing. and fine board.
2) Top felts for open Yankee machines and glazing felts where it is important to keep the felt dry.
3) The final stage of the pressing operation where an even pressure distribution is important for the dry content of the paper sheet.
4) Presses with hard nips with high demands on wear resistant felts.

Up to the spring of 1972, Nordiskafilt has delivered well over 200 non-woven press felts, NOVOTEX, with very encouraging results, and we can see a further development towards increased use of this technically very advanced wet felt type.

Combination fabrics

(The fabric press and the batt-on-mesh felt COMBITEX)

Fabric Press

The fabric press is defined as a press with a free-running plastic fabric and separate felt. Figure 11 shows an example of a fabric press The innerbelt inside the felt is preferably made of an incompressible double-layer, monofilament plastic fabric The function of the innerfabrics is to create incompressible pores or void spaces under the felt in the press nip in order to reduce the hydraulic pressure within the clothing outside the paper web. This allows a more efficient pressing, because the risk for crushing is diminished and a higher nip load can be employed.

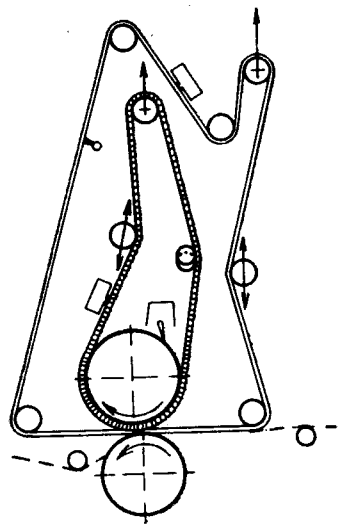

Fig 11

The inner fabric is generally used on solid press rolls, but sometimes it is also used on suction rolls. The fabric press belongs to the group of transversal flow presses like the grooved press, the blind-bored (drilled) press and the Hi-I press. The suction press was a first step towards the transversal-flow-press principle, where efficiency was hindered by too big distance from hole to hole.

The fabric press was invented by PCL, the Central Laboratory of the Swedish Paper Industry. Nordiskafilt has taken an active part in the development of this press and we are continuously helping customers in designing fabric presses for different purposes. Nordiskafilt is almost without competition and thus the biggest supplier of plastic fabrics for this press.

Figure 12 shows a newly started Inverform machine for white board and liner with three fabric presses. Nordiskafilt, of course, also delivers felts to this press. The development is towards high-synthetic, needled felts. The felts are generally easy to keep clean as the plastic fabric underneath acts like a washing equipment.

In this connection, I should like to mention that the world's biggest paper machine, a 10-m-wide liner machine started-up at the end of 1971. It is provided with three fabric presses with all innerbelts supplied by Nordiskafilt. Production capacity was calculated to 1,500 tons a day, which means more than 1 ton per minute but they have actually already reached over 1700 tons a day.

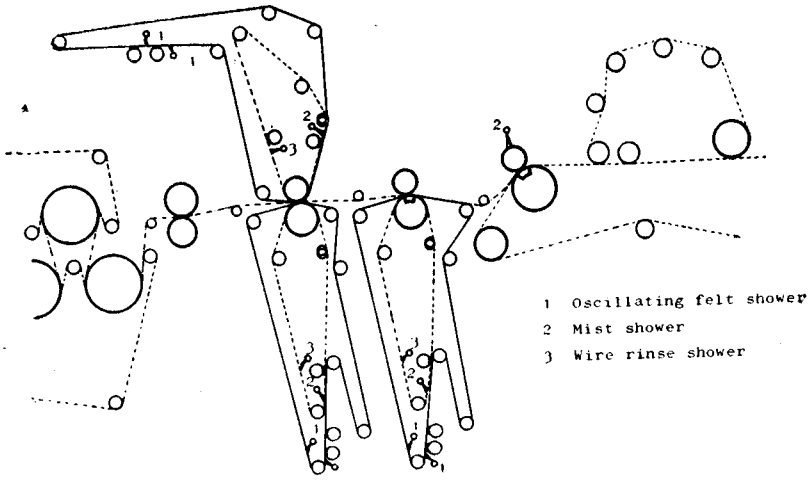

Fig. 12

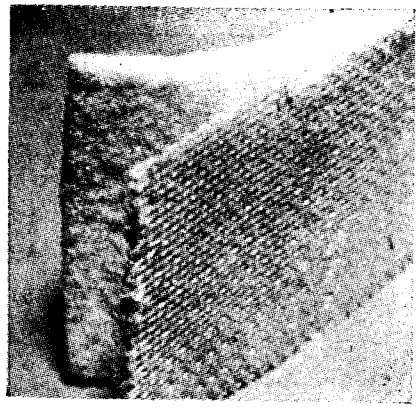

Fig. 15

COMBITEX—abatt-on-mesh felt

COMBITEX is a press clothing in which the technical advantages of the fabric press are utilized. Felt and fabric are combined into one single clothing. The design is protected by Nordiskafilt patents in several countries with a priority from 1960.

The principal design of COMBITEX is shown in Figure 13. Figure 14 shows a magnified photo of a cut-away of a COMBITEX. By combining a double-layer fabric that contains mainly monofilaments with a needled fibre batt, the following properties are obtained :

1) The baseweave has a low compressibility and a large pore volume.
2) The water permeability in the lengthwise direction is high and allows a free flow out of the press nip.

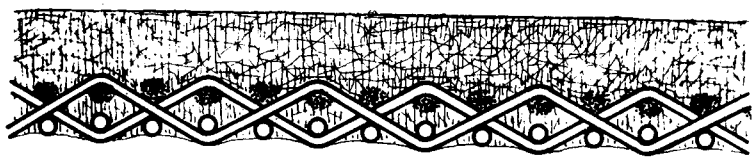

Fig. 13

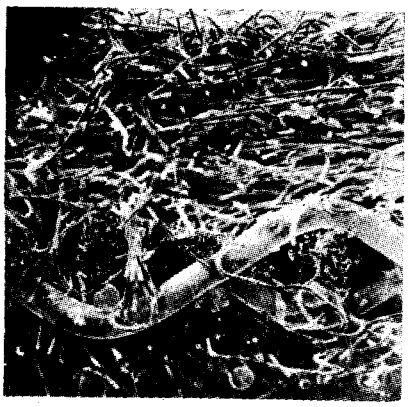

Fig. 14

3) The top layer is even and compressible and gives a uniform pressure distribution in the nip.

COMBITEX is manufactured like a needled felt by needling a layer of textile fibres into a relatively open baseweave (Figure 15). The baseweave and the fibre batt consist of 100% synthetic fibres.

Water permeability is very high even during compression in the press nip. Figure 16 shows the flow

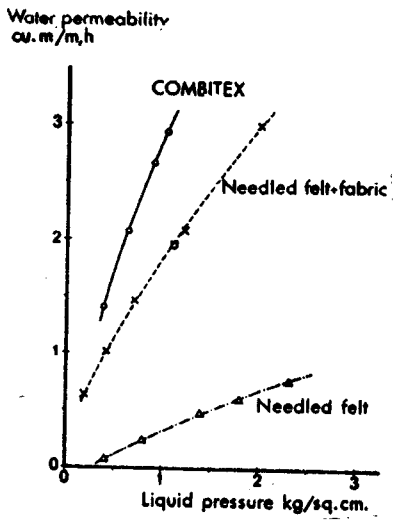

Fig. 16

of water through different clothings plotted against the hydraulic pressure.

The amount of water pressed out at a given hydraulic pressure is larger for a COBITEX than for a felt plus a free fabric and much larger than for a needled felt in a plain press.

We like to define COMBITEX as something more than a felt. It is both a felt and a machinery element because it converts a solid press into a so-called transversal flow press. The incompressible plastic fabric in the COMBITEX corresponds to the incompressible void areas that we can see as hole pat-

terns in the suction press or blind-drilled roll's surface and in the grooves of the Venta press, or as the separate fabric of the above-mentioned fabric press.

As a rule, COMBITEX is used on solid presses, but it is also used on suction presses, e. g. for thick board grades to avoid suction hole marking and still receive a very high dewatering rate. I should like to mention a unique record with COMBITEX on a 4,3-m-wide modern board machine. On the first suction press, a COMBITEX of 1209 g/sq m. was in operation for 15 months. They manufacture Duplex and Triplex board at 30 and up to 80 m/min.

Within this short survey of different types of felts. it is impossible to cover even the most important things, and also COMBITEX should be given more time. I shall only mention that COMBITEX belongs to the group "combination felts", which have a small or no compressibility and cannot be dried by pressing in a squeeze press. The only way to dry them is to use suction boxes with sufficient air velocity through the slot. We recommend using a box with a 10-mm-wide slot. Air quantity will generally be 4 cu.m. of attenuated air per metre suction box, while maintaining a vacuum of 4m wg in the box. The question concerning dewatering of COMBITEX is very important and determines entirely whether the appilcation will be a success or not. Therefore, full instructions are always given by Nordiskafilt when delivering these types of paper machine clothing to new customers.

Summary

The rapid acceleration of the share of high-synthetic, needled wet felts-depends, of course, on their being superior to the earlier conventional, woven felts. There are three main groups of needled wet felts with their own running characteristics, depending on their different compressibilities. The groups are: conventional, needled wet felts, non-woven, and combination felts. Only felts from the first group are still made with a wool content.

During recent years, Nordiskafilt has developed a series of new fabrics. Already in 1960, we filed a patent application for COMBITEX; the combination felt. We have also actively taken part in the development of the fabric press, and designed suitable combinations of felts and plastic fabrics for this very effective press type. Recently, we obtained the patent for PERMATEX, the felt with the special stabilized baseweave. Nordiskafilt has also developed its own methods and designed machinery for the manufacture of the entirely baseless, non-woven product called NOVOTEX. This is a new type of press felt, that we have every reason to believe will be a success in the near future.